U.S. Department of Energy
Office of Inspector General
Office of Audit Operations

Audit Report

The Los Alamos Neutron Science Center

DOE/IG-0666

November 2004

Department of Energy

Washington, DC 20585

November 30, 2004

MEMORANDUM FOR THE SECRETARY

FROM: Gregory H. Friedman
Inspector General

SUBJECT: INFORMATION: Audit Report on "The Los Alamos Neutron Science Center"

BACKGROUND

The Los Alamos Neutron Science Center (LANSCE), located at Los Alamos National Laboratory (Los Alamos), was constructed in 1972. LANSCE is a national user facility that provides pulsed protons and spallation neutrons for defense and civilian research and related applications. Its primary mission is to support the National Nuclear Security Administration's (NNSA) stockpile stewardship activities; the Office of Science in the areas of neutron scattering and nuclear physics research; and, the Office of Nuclear Energy, Science and Technology in radioactive isotope production. NNSA provided $65 million of LANSCE's $90 million Fiscal Year 2003 budget and has overall responsibility for management of the facility.

Because of its multi-program mission, an Executive Council, consisting of representatives from Los Alamos and each of the sponsoring organizations, was established in 2001 to address LANSCE-related issues at the Department level. NNSA and the Executive Council are charged with establishing funding priorities and determining the long-term mission for the facility. Based on the potential mission and economic impact of such decisions and the age and condition of the facility, we initiated this audit to determine whether LANSCE can satisfy future programmatic research needs.

RESULTS OF AUDIT

The ability of LANSCE to provide needed research capabilities in the future is uncertain. Increasing reliability problems, coupled with the lack of a long-term plan detailing funding and mission priorities, increased the risk that LANSCE may not be capable of operating effectively in the future. In particular, we observed that:

- Annual reliability has declined to 77 percent, 8 percent less than the standard for similar scientific facilities, and fell to a low of 44 percent in August of 2003;
- Major components have become obsolete, are years beyond their expected service lives, and could cause a shutdown of up to one year while replacements are custom fabricated; and,

- Deferred maintenance has accumulated to over $42 million.

Although, LANSCE officials have proposed a $138 million project to sustain operations into the next decade, NNSA and the Executive Council have yet to complete the analysis necessary to determine whether the facility has a viable future mission. Specifically, issues such as the age and condition of the facility, the investment needed to make it reliable, and the availability of the Spallation Neutron Source and similar alternative facilities have not been formally evaluated and factored into future mission requirements. Without such study and a mission need determination, it is likely that LANSCE's beam will continue to deteriorate and the facility may suffer extended outages. In addition, the Department will continue to expend about $90 million annually to operate a facility that may not satisfy long-term mission needs.

The Director of Los Alamos has stated that LANSCE is important to the weapons program and the Laboratory's scientific enterprise; however, due to the large amount of funds needed to revitalize LANSCE, support from all Executive Board members is required if it is to remain viable. In that connection, we recommended that the Administrator, NNSA, and the LANSCE Executive Council determine whether LANSCE has a viable mission within the Department, considering, at a minimum: other similar facilities; the condition of the LANSCE facility; future investment requirements; and, the projected future usage level.

MANAGEMENT COMMENTS

NNSA generally agreed with the findings and recommendations and plans to prepare an action plan to resolve the issues raised in the report. Management's comments are included in their entirety as Appendix 3.

Attachments

cc: Deputy Secretary
Administrator, National Nuclear Security Administration
Under Secretary for Energy, Science, and Environment

REPORT ON THE LOS ALAMOS NEUTRON SCIENCE CENTER

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Capability of LANSCE

Increasing reliability problems, combined with the absence of a long-term plan, increased the risk that the Los Alamos Neutron Science Center (LANSCE) may not be capable of operating effectively in the future. Specifically, we determined that:

- Annual beam reliability has declined to 77 percent – 8 percent below the national standard for similar accelerators;
- Major components have become obsolete, are years beyond their expected service lives, and could cause a shutdown of up to nine months while replacements are custom fabricated; and,
- Deferred maintenance has accumulated to over $42 million.

Beam Reliability

Since LANSCE's primary mission is to provide the scientific community with the capability to perform experiments, its highest priority is to provide reliable delivery of the beam. However, beam reliability has declined over the past few years from 92 percent in 2001 to 77 percent in 2004. In August 2003, the beam reliability rate dropped to 44 percent due in part to equipment failures attributed to a water main and an O-ring failure, and a water-to-vacuum leak in the accelerator. These failures highlight the vulnerabilities associated with an aging accelerator. The Deputy Director for LANSCE expressed the opinion that beam reliability would continue to decline if LANSCE is not refurbished.

Aging Equipment

Many of the components needed to sustain the reliable operation of LANSCE are at the end of their useful lives or have become obsolete and have no available replacements or replacements requiring significant lead-time. For example, a component called a radio-frequency power source has a designated useful life of about 35,000 hours. A total of 44 of these are in use at LANSCE with an average in-service time of over 100,000 hours. All 44 must be in service to operate the accelerator and only 11 spares are available. Using the average known failure rate of one per month during a normal 6-month operating cycle per year, expected failures could cause operations to terminate after two years.

Large transformers in service at LANSCE have also reached the end of their useful life. LANSCE officials expect failures within the next five years that will result in substantial outages due to long

procurement lead times. Finally, a component spare used to support the neutron target moderator reflector system has no available spare. If this component fails, LANSCE will encounter a minimum of one year of downtime with no operations – an outage that would drastically affect a wide variety of weapons program and Office of Science funded activities.

Deferred Maintenance

LANSCE also has accumulated over $42 million in deferred maintenance. Deferred work includes the replacement of two target assemblies used to prevent the build up of radioactive material at an estimated cost of $7 million. The remediation of Area-A – estimated to cost $10 million – has also been postponed. Action in Area-A is necessary to reduce the need to construct a new Laboratory/shop space.

Los Alamos planned to use Readiness and Technical Base Facilities and Facility Infrastructure Revitalization Program funds to address ongoing and deferred maintenance needs; however, these funds are not adequate to fully sustain reliable operations. According to LANSCE personnel, correcting known deficiencies and instituting a full predictive maintenance program is critical to maintaining future operations.

Future Viability

While LANSCE officials have proposed a $138 million project to sustain operations for about 10 years, the National Nuclear Security Administration (NNSA) and the Executive Council – comprised of representatives from NNSA; the Office of Science; the Office of Nuclear Energy, Science and Technology; and the Los Alamos Area Office – have yet to complete the formal analysis necessary to determine whether the facility has a viable future mission. Specifically, issues such as the age and condition of the facility, the investment needed to make it reliable, and the availability of the Spallation Neutron Source and similar facilities have not been formally evaluated and factored into future mission requirements.

Refurbishment Proposal

In May 2004, LANSCE officials proposed the $138 million refurbishment project that they believed would sustain reliable facility operations into the next decade. The project would address four major priorities:

- Replacing facility equipment necessary to address code compliance or end-of-life issues that could severely impact facility operations;
- Enhancing cost effectiveness by system refurbishments or improvements that stabilize decreasing facility reliability and maintainability;
- Stabilizing the overall beam availability and reliability in a manner that is sustainable over the longer term; and,
- Accomplishing the above with minimal disruption to the scheduled user programs.

LANSCE personnel have stated that, while the $138 million funding profile should address current issues, it is not sufficient to sustain operations beyond the next decade.

Mission Analysis

Neither the Executive Council nor NNSA have performed an analysis to determine if LANSCE has a viable future mission. Executive Council representatives, who include representatives from NNSA, have had discussions on issues regarding financial commitments, LANSCE's role in the post-Spallation Neutron Source world, accelerator reliability, and the mission of LANSCE in the weapons program beyond 2012. However, the Executive Council has not conducted a formal analysis to consider more specifically issues such as the current condition of the facility, the investment needed to make it reliable, and the facility's projected future use.

Similar neutron scattering facilities such as the ISIS in Europe, the Intense Pulsed Neutron Source at Argonne National Laboratory, and the Spallation Neutron Source facility, which comes on line in FY 2006, at the Oak Ridge National Laboratory, also need to be considered when evaluating the need to continue LANSCE operations. Executive Council minutes indicated that NNSA has been hesitant to invest in revitalizing LANSCE. The Director of Los Alamos has also indicated that as a result of reduced funding, needed upgrades, different operating reliability expectations, and the growing capabilities of other neutron scattering facilities, support of LANSCE within Los Alamos is mixed. Further, he has stated that while LANSCE is important, support from all the Executive Council partners is needed if the facility is to be revitalized.

Consequences

Until NNSA thoroughly reviews the refurbishment proposal and performs an analysis of future viability, a determination cannot be made as to whether LANSCE can fulfill its mission cost effectively. In the interim, beam reliability will continue to decline and the facility may experience extended outages, causing delays for its users. In addition, approximately $90 million annually will be expended on a facility that may not satisfy long-term mission needs.

RECOMMENDATIONS

We recommend that the Deputy Administrator for Defense Programs, NNSA, in coordination with the LANSCE Executive Council:

1. Determine whether LANSCE has a viable mission within the Department, considering, at a minimum:
   - Other similar facilities;
   - The condition of the facility and the investment required to make it reliable; and,
   - The projected future usage level.
2. Based on the mission determination, develop plans to:
   - Address upgrades and deferred maintenance issues by implementing refurbishment projects, or
   - Shut down the facility and migrate current tasks to other facilities.

MANAGEMENT REACTION

The Associate Administrator for Management and Administration generally concurred with the findings and recommendations and stated that an action plan would be prepared to resolve the issue raised in the report. Management's comments are included in their entirety as Appendix 3.

AUDITOR COMMENTS

Management's comments are responsive to our recommendations.

APPENDIX 1

OBJECTIVE

The objective of this audit was to determine whether LANSCE could satisfy future programmatic research needs.

SCOPE

The audit was performed from September 2003 to May 2004 at NNSA Headquarters and the Los Alamos National Laboratory. The audit examined Fiscal Years 1999 to 2003.

METHODOLOGY

To accomplish the audit objective, we:

- Reviewed applicable Public Laws, Department Orders, other departmental guidance, related correspondence, and contracts;
- Obtained and reviewed prior Office of Inspector General and General Accounting Office reports;
- Determined compliance with the *Government Performance and Results Act of 1993*;
- Obtained, reviewed, and analyzed LANSCE's Governance Plan;
- Reviewed Los Alamos National Laboratory Institutional Plans;
- Interviewed key Headquarters, Field, and Laboratory personnel;
- Reviewed and analyzed contents of Minutes from LANSCE Executive Council meetings in 2003;
- Analyzed the dollar value and the proposed projects contained in the Deferred Maintenance and Upgrades Listing; and,
- Reviewed and analyzed the Refurbishment of the Los Alamos Neutron Science Center proposed LANSCE-R Draft Document.

The audit was conducted in accordance with generally accepted Government auditing standards for performance audits and included tests of internal controls and compliance with laws and regulations to the extent necessary to satisfy the objective of the audit. Accordingly, we assessed the significant internal controls and performance measures established under *The Government Performance and Results Act of 1993*. We found that there were no performance measures for reliable beam operation of LANSCE. Because our review was limited, it would not necessarily have

disclosed all internal control deficiencies that may have existed at the time of our audit. We did not test the reliability of computer-processed data because we did not consider the information critical to achieving our audit objective. We discussed the findings with management on November 10, 2004.

APPENDIX 2

PRIOR REPORTS

Office of Inspector General Reports

- *The Department of Energy's Audit of the Synchrotron Radiation Light Sources at Lawrence Berkeley National Laboratory and Stanford Linear Accelerator Center* (DOE/OIG-0562, July 2002). The report found that the beam lines at the Stanford facility were being used to the fullest extent practicable. In contrast, however, this was not the case at the Berkeley facility. Specifically, the beam lines at Berkeley were idle 35 percent of the time, during a period in which 150 scientifically valid research proposals had been rejected. Berkeley did not have a centralized scheduling system and, therefore, was unaware that additional beam time was available. As a consequence, independent researchers were unnecessarily turned away.

- *Cost Sharing at Basic Energy Sciences' User Facilities* (DOE/IG-0441, March 1999). The report found that cost sharing could enhance scientific research at BES user facilities. Funding shortfalls have prevented BES' user facilities from operating at optimum levels. Both facility representatives and advisory panels have concluded that additional funding is needed to increase beam operating time and quality, to upgrade facilities, and to provide needed staff.

- *Audit of The Department of Energy's User Facilities* (DOE/OIG-0395, August 1996). The report found that Los Alamos National Laboratory and the Idaho National Engineering Laboratory (INEL) did not always price user facility agreements at full costs. Los Alamos inappropriately waived Department added factor and depreciation costs on user facility agreements executed prior to establishment of its Technology Deployment Center/User Facilities. INEL also inappropriately waived added factor and depreciation costs, and did not recover general and administrative and overhead costs on some agreements.

Other Reports

- *LANSCE Activity Report: Technical and Infrastructure Accomplishments* (LA-14036-PR, Progress Report, January – December 2002). The report found that investment in the physical infrastructure has not kept pace with that required for long-term sustainable operation at high reliability.

- *Department of Energy: Report of the Basic Energy Sciences Advisory Committee Subpanel Review of the Manuel Lujan Jr. Neutron Scattering Center at Los Alamos National Laboratory* (DOE/SC-0037, February 2001). The report found that the Lujan Center's performance as a user facility has been far below expectations. Shortfalls include inadequate beam time delivered to the Lujan Center, and inadequate management performance as reflected in lack of clear inspectable problem-solving plans.

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

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MEMORANDUM FOR Rickey R. Hass
Assistant Inspector General
for Audit Operations

FROM: Michael C. Kane
Associate Administrator
for Management and Administration

SUBJECT: Comments to IG's Draft Report on LANSCE

The National Nuclear Security Administration (NNSA) appreciates the opportunity to have reviewed the Inspector General's (IG) draft report, "The Los Alamos Neutron Science Center." We understand that the IG conducted this audit to determine if the project is meeting program objectives and specifically, what LANSCE is doing for NNSA and the inter-relationship is with the Office of Science.

NNSA agrees, in general, with the IG's report and corresponding recommendations. We will prepare our action plan for resolution of issues after the final report is issued.

NNSA agrees with the IG's findings that many of the components of the LANSCE facility are obsolete or beyond their expected service life, and that there has been excessive accumulation of deferred maintenance. We also agree with the IG that these conditions have resulted in a reduction in beam availability and concerns about the ability of LANSCE to operate effectively in the future.

NNSA and the Laboratory have been aware of the equipment degradation at LANSCE as well as the need to define the future course of the facility. The Program informed the auditors, at the commencement of the audit, that while there have been recent management improvements and maintenance projects have substantially improved conditions at the facility, there is much to be done.

The Laboratory performed a LANSCE Facility cost study during Fiscal Year 2001, the results of which became a base for discussions between NNSA and the Laboratory on refurbishment scope, schedule, and funding. While these discussions are ongoing, the recent Laboratory safety and security shutdown has delayed some of the deliberations. We certainly agree with the IG that NNSA must complete the process of determining future mission needs and funding

priorities for the facility. NNSA anticipates those decisions to be made during Fiscal Year 2005.

Should you have any questions related to this response, please contact Richard Speidel, Director, Policy and Internal Controls Management. He may be reached at 202-586-5009.

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